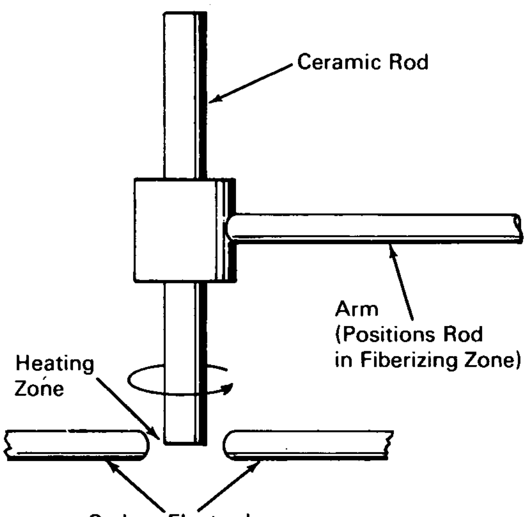
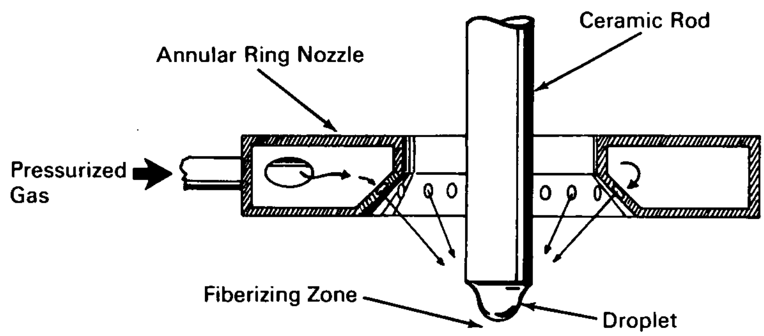
NASA TECH BRIEF

Fibers of Newly Developed Refractory Ceramics Produced by Improved Process





The problem:

To develop a series of ceramic materials and glasses having relatively high fusion temperatures and tensile strengths and to devise an efficient process for converting these materials, as well as standard refractory ceramic compositions, into fibers. Present methods do not adequately control processing parameters, such as viscosity, temperature, and gas jet directivity; hence they produce relatively low yields of usable fibers.

The solution:

Several refractory compositions and a controlled fiberizing process that subjects rods of these compositions to alternate fusion and gas-jet bursts. A typical ceramic composition consists of silica (50%), alumina (27%), magnesia (3%), and zirconia (20%) and yielded fibers having a fusion point of 1580°C and a tensile strength of 267,000 psi.

How it's done:

The ceramic compositions are prepared from chemically pure oxides mixed with water and sufficient organic binder to provide the proper consistency for extrusion through a one-half-inch-diameter vacuum die, with the aid of a hydraulic press. The extruded rods, cut into 8-inch lengths, are then dried and sintered in air at 1250° C. The sintered rods are fiberized as described below.

A ceramic rod, while being rotated about its longitudinal axis, is held in a vertical position at the end of an arm, with the tip of the rod positioned between two carbon electrodes. Current supplied to the electrodes heats the tip of the rotating rod, producing a relatively uniform, homogeneous droplet of the ceramic material.

After rotation is stopped, the rod is removed from the heating zone and transferred to the fiberizing zone,

(continued overleaf)

where the droplet is positioned at the apex of a cone that will be formed by the gas streams issuing from perforations in the annular ring nozzle. A burst of gas at a pressure of 250 to 350 psi, then admitted into the gas chamber of the nozzle, issues from the perforations in jets directed against the ceramic droplet. This action converts a portion of the droplet into fibers. The pressure and duration of the gas burst depend largely on the material being fiberized and the effect of cooling on the droplet. After the maximum yield of fibers is obtained from the droplet, the rod is returned to the heating zone and the process is repeated.

Notes:

1. Other sources of heat may be used in place of carbon-electrode arcs for fusing the tip of the ceramic rod.
2. The refractory, high-tensile-strength fibers produced by this process may be combined with suitable binders to produce heat-resistant fabrics and rigid structures.
3. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Western Operations Office
   150 Pico Boulevard
   Santa Monica, California, 90406
   Reference: B66-10196

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C., 20546.

Source: Hughes Aircraft Company
under contract to
Western Operations Office
(WOO-169)